Large scale analysis of video material in cases of disasters

J. Bijhold
Netherlands Forensic Institute of the Netherlands Ministry of Justice, The Hague, Netherlands

In forensic investigations of disasters, it could be necessary to carry out a reconstruction of all movements made by people and cars just before, during, and after a big incident. The goal is to find not only perpetrators, but victims and eyewitnesses as well. Methods and technology are presented that are based on the widespread availability of video footage from CCTV systems and phone cams, and intelligence such as cell phone traffic data. Analysis of all video data is based on the concept of events on a time line and the use of 2-D maps, aerial photography, and 3-D city and terrain models. All methods and technology will be demonstrated with case data from capital crimes. The presented was carried out within the framework of a 3-year project. A brief overview is given of other results such as automated procedures for the analysis and technology for fast 3-D modelling from imagery.

doi:10.1016/j.scijus.2009.11.036

Crime scene reconstruction using 3-D scanning and medical imaging technologies

S. Naether[a,b], U. Buck[a,b], B. Raess[c], M. Thali[a]
[a]University of Bern, Institute of Forensic Medicine, Bern, Switzerland
[b]State Police Bern, Technical Accident Service, Bern, Switzerland
[c]State Police Aargau, Forensic Service, Aargau, Switzerland

The analysis and reconstruction of forensically relevant events, such as traffic accidents, criminal assaults, and homicides are based on external and internal morphological findings of the injured or deceased person and of the geometry of the involved vehicles or injury causing instruments. For this approach, high-tech methods like radiological imaging and 3-D optical surface scanning have gained importance in forensic investigations during the last years. The non-contact optical 3-D digitizing system GOM ATOS is applied as a suitable tool for whole body surface and wound documentation and analysis in order to identify injury-causing instruments and to reconstruct the course of events. In addition to the surface documentation, cross-sectional imaging methods deliver medical internal findings of the body. This 3-D data is fused into a whole body-model of the deceased. 3-D data of the incident scene, generated by 3-D laser scanning and photogrammetry, is also included into the reconstruction. In the present case a woman was hit by a car, driving backwards into a garage. It was unclear if the driver drove backwards once or twice, which would indicate that he willingly injured and killed the woman. This work illustrates the methods, which can be employed for the documentation of deceased persons and incident scenes. It demonstrates how 3-D documentation, data merging, and animation enable the answer of reconstructive questions regarding the dynamic development of patterned injuries, and how this leads to a real data-based reconstruction of the course of events.

doi:10.1016/j.scijus.2009.11.037

Non-invasive detection of explosives at the crime scene

A.C. van Asten, J. Dalmolen, M. Koeberg, A. Schoina, T. Pacqué
Netherlands Forensic Institute, Physical and Chemical Technology, The Hague, Netherlands

A few times a year the Dutch Police are faced with crime scenes that could contain dangerous materials such as explosives and their precursors. Even at the slightest risk of an explosion, bomb experts from the Dutch Army (EOD) are called to the crime scene. Regularly also forensic explosives experts from the Netherlands Forensic Institute (NFI) are consulted to provide advice and assist in identifying the unknown materials. After the crime scene is secured, the EOD assesses the situation and decides the course of action. If an immediate threat is judged to exist, it can be decided to evacuate the area, after which the EOD neutralises the threat by controlled explosion of the suspect materials. Threat assessment is based on visual inspection, experience, and microchemical test kits for explosives (the so-called DROP-EX kit). The use of test kits has two important disadvantages: first, it does not allow absolute identification and secondly, it requires physical handling of the unknown materials to be investigated. Physical handling poses additional risks for an accidental explosion whereas false positive tests may result in unnecessary waste of resources in an attempt to neutralise a non-existing threat. Additionally, unnecessary neutralisation actions also severely hamper subsequent forensic investigation at the crime scene. For these reasons, the Explosives and Explosions team of the NFI has engaged in a research effort to develop methods for the non-invasive detection of explosives at the crime scene. Two technologies have been studied in detail: mobile Raman spectrometry and vacuum outlet GC-MS (gas chromatography with mass spectrometric detection) in combination with SPME (solid phase micro extraction) sampling. Latest results will be presented to demonstrate that both techniques have strong potential for offering mobile, robust, fast, and non-invasive identification of hazardous materials at a crime scene.

doi:10.1016/j.scijus.2009.11.038

Recovery of latent fingerprints and DNA on dead bodies

D. Färber
Bundeskriminalamt, Crime Scene Unit, Wiesbaden, Germany

In post-mortem police casework, evidence of offender contact on the skin surface of the homicide victim has to-date been regarded as almost impossible to detect in Europe, as indeed has forensic analysis of such evidence. The initial success of series of tests at a national level initiated by the German Federal Criminal Police (Bundeskriminalamt) started in 2000 were the bases of the project 'Latent Fingerprints and DNA on Human Skin' funded by the European Union. This project was carried out in cooperation with Denmark, The United Kingdom, Austria, and Germany (project management) in a time frame of two years. The project had two main objectives, the recovery of latent fingerprints on human skin with simple means and little effort and secondly the recovery and extraction of DNA from these latents. In this study, a total of 1000 fingerprints were deposited on corpses in the morgue. The latent prints were enhanced with magnetic powder or black fingerprint powder. Following, the latents were secured either with silicone casting material or gelatine foil in order to extract the DNA from the lifts. The trials carried out have shown that it is possible to visualise a considerable number of identifiable fingerprints on the skin of corpses (16%). The project was also successful in demonstrating that it was possible to recover and extract DNA from the powdered latents (2%).

doi:10.1016/j.scijus.2009.11.039

Human provenancing based on stable isotope forensic intelligence

W. Meier-Augenstein[a,b], H.F. Kemp[b]
[a]University of Dundee, Centre for Anatomy and Human Identification, Dundee, United Kingdom
[b]Scottish Crop Research Institute, Stable Isotope Laboratory, Invergowrie, Dundee, United Kingdom

Forensic science already uses a variety of methods often in combination to determine a deceased person's identity when identification is